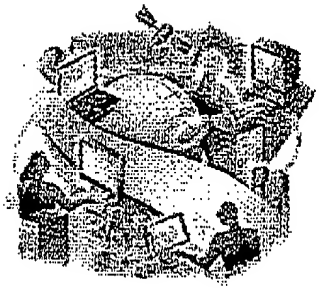
Exhibit D



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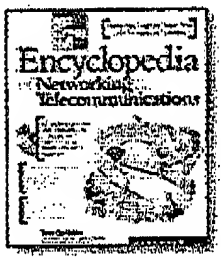

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NHRP (Next Hop Resolution Protocol)

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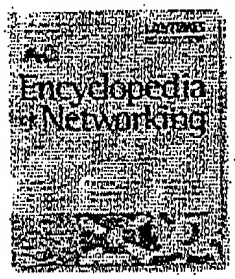
There is a whole range of protocols and schemes that attempt to integrate IP and ATM networks. Classical IP over ATM, or CIP, is one such method. CIP uses an ATM network as its underlying data link network. CIP implements the concept of a *LIS (logical IP subnet)*, which is a closed logical IP subnetwork consisting of a group of hosts.

In CIP, an ATM attached host communicates with an ATMARP server to resolve IP-to-ATM address mappings. All communications within a LIS can take place over ATM PVCs or SVCs. All communication between different LISs requires an IP router to forward the packets. What NHRP does is provide a way for inter-LIS traffic to use ATM SVCs (shortcut paths) rather than go through the router. This improves performance as traffic flows across a direct switched virtual circuit. NHRP makes the ATM network appear as a *single-hop* between source and destination.

Shortcut routing works as follows. If a long flow of packets is being transmitted, NHRP makes a decision about whether the flow is going to be long enough to warrant setting up a virtual connection. The decision is based on a default number of packets, usually ten. If a flow exists,



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NHRP goes to work to obtain the destination ATM address so a virtual circuit can be set up. An NHRP query goes out over the routed hop-by-hop path (which consists of individual ATM circuits between routers) to the destination and the answer is returned along this path to the source. The source then establishes a virtual circuit across the ATM network directly to the destination, bypassing the hop-by-hop routers and improving performance.

Note that NHRP is an *address resolution* protocol that queries other routers across logical IP networks on top of ATM networks. NHRP resolves the given IP address of a destination, no matter what LIS, into its corresponding ATM address. Once the ATM address is known, a virtual circuit can be set up between LISs.

Three important RFCs are listed here. Others are listed on the related entries page.

- RFC 1932 (IP over ATM: A Framework Document, April 1996)
- RFC 2332 (NBMA Next Hop Resolution Protocol, April 1998)
- RFC 2333 (NHRP Protocol Applicability Statement, April 1998)

The ATM Forum integrated LANE and NHRP to provide a generic bridging and routing environment called MPOA (Multiprotocol over ATM).